MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2015/2016

TAI2151 – ARTIFICIAL INTELLIGENCE FUNDAMENTALS

(All Sections/Groups)

4 March 2016
3.00pm – 5.00pm
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of **5** pages with **6** questions only.
2. Attempt **FIVE** out of **SIX** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the answer booklet provided.

Question 1

(a) *Define an agent and a rational agent.* (2 marks)

(b) The Turing test was designed to provide a satisfactory operational definition of intelligence. A human communicates with a computer via a teletype. The objective is to find out whether the human can tell he/she is talking to a computer or another human.

(i) To pass the test, the agent (i.e. the computer) will need to possess 4 capabilities. List all 4 capabilities. (2 marks)

(ii) To pass the total Turing test, list the 2 additional capabilities that the agent will need to possess. (1 mark)

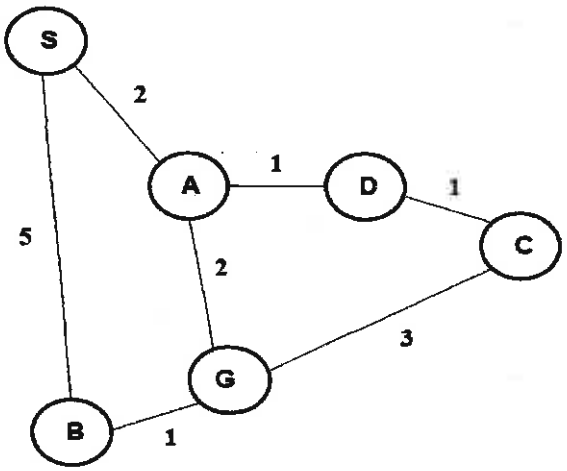
(c) Based on percepts, actions, goals and environment, agents can be basically classified as goal-based, simple reflex, reflex with state, or utility-based agents. Compare the differences of each type of agent. (4 marks)

(d) What is the claim made by strong AI as opposed to weak AI. (1 mark)

Continued....

Question 2

Given the following graph where ***S*** is the starting node and ***G*** is the goal node. Numbers related to arcs between nodes indicate step costs.



(a) Trace Graph-Search algorithm using Breadth-First Search strategy:

(i) Show the order in which nodes are added to the fringe (a queue of expanded nodes) (1 mark)

(ii) Show the generated tree and the solution path. Do not add a state as a leaf if that state is on the path from the root to the current node of the generated tree. Nodes are added to the tree in alphabetical order. (3 marks)

(iii) Indicate if found solutions are optimal. (1 mark)

(b) Trace Graph-Search algorithm using Depth-First Search strategy:

(i) Show the order in which nodes are added to the fringe (a queue of expanded nodes) (1 mark)

(ii) Show the generated tree and the solution path. Do not add a state as a leaf if that state is on the path from the root to the current node of the generated tree. Nodes are added to the tree in alphabetical order. (3 marks)

(iii) Indicate if found solutions are optimal. (1 mark)

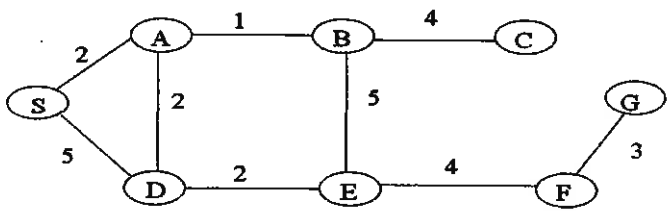
Continued....

Question 3

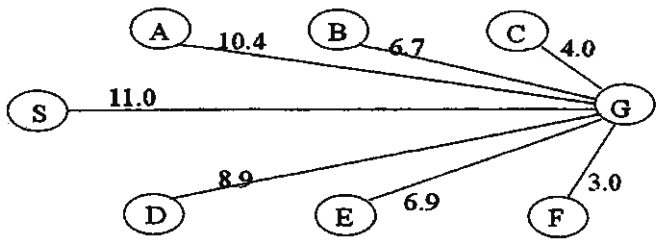
(a) What is an admissible heuristic function? (2 marks)

(b) Why the straight-line distance for each node in a graph to the goal node is an admissible heuristic function? (2 marks)

(c) Given the following map with the actual distances display on it, workout the solution path and the path cost from S to G using A* Search.



The following figure shows the straight-line distances for each node to G:



(6 marks)

Continued....

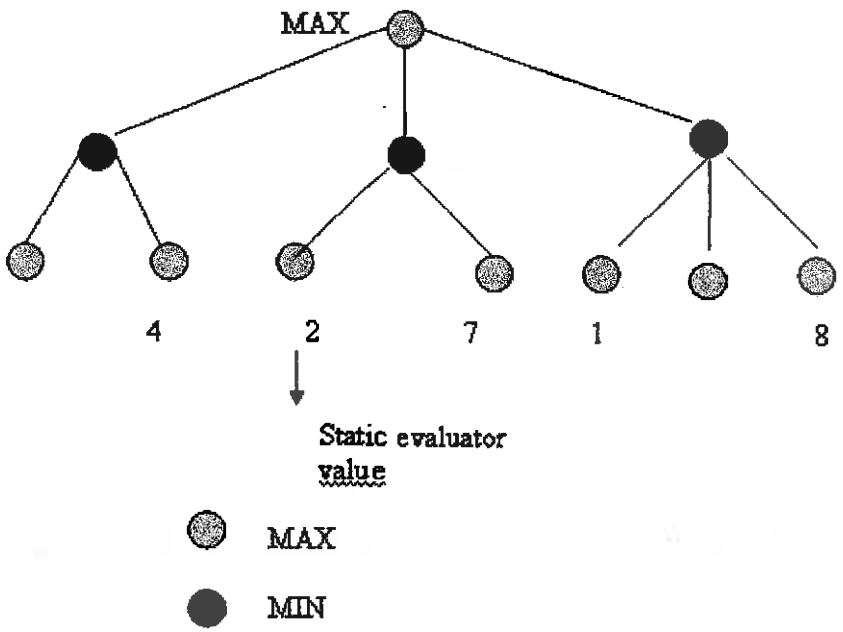
Question 4

(a) In a multi-agent environment, the agents can interact in numerous ways. List the four different types of interactions. (2 marks)

(b) Define game and describe game-playing agent for two-player game using any method for chess playing. (2 marks)

(c) Pruning and heuristic evaluation functions are techniques used for choosing a good move due to time constraint. Describe the use of pruning and evaluation function. (2 marks)

(d) Determine the move selected by Minimax Algorithm for the following game tree. Determine the maximum depth and branching factor for the search tree.



(4 marks)

Continued....

Question 5

(a) Translate the sentence "Birds fly except penguins." into first-order logic statements, assuming the following predicates have been defined:

Bird(x) = *x* is a bird
Penguin(x) = *x* is a penguin
Fly(x) = *x* flies (2 marks)

(b) From "Horses are animals," it follows that "The head of a horse is the head of an animal." demonstrate that this inference is valid by carrying out the following steps:

(i) Translate the premise and the conclusion into the language of first-order logic. Use three predicates: *HeadOf(h,x)*, *Horse(x)*, and *Animal(x)*. (2 marks)
(ii) Negate the conclusion, and convert the premise and the negated conclusion into conjunctive normal form. (3 marks)
(iii) Use resolution to show that the conclusion follows from the premise. (3 marks)

Question 6

A candy manufacturer interviews a customer on his willingness to eat a candy of a particular colour or flavour. The following table shows the collected responses:

Colour	Flavour	Edibility
Red	Grape	Yes
Red	Cherry	Yes
Green	Grape	Yes
Green	Cherry	No
Blue	Grape	No
Blue	Cherry	No

For your information, $\log_2 1 = 0$, $\log_2 2 = 1$, $\log_2 3 = 1.6$, $\log_2 4 = 2$, $\log_2 5 = 2.3$
Also, $\log(x/y) = \log x - \log y$

(a) What is the information content of the feature edibility, *I(Edibility)*? Show your work. (2 marks)

(b) What is the information content of the feature edibility knowing a particular colour, *I(Edibility | Colour)*? Show your work. (2 marks)

(c) Which feature (colour or flavour) has the larger mutual information with edibility? (2 marks)

(d) Draw the decision tree for predicting edibility that maximizes the information gain. (2 marks)

(e) Using your decision tree, what would you predict for the edibility of a blue, blueberry flavoured candy? (2 marks)

End of Paper